THE PLUMED BEES.

By TARLTON RAYMENT.

Fred Smith, working on the hymenoptera in the British Museum, described many Australian bees which that institution had received from collectors in the antipodes. Among the remarkable insects from the new country were a few black bees, having bright golden bands on the abdominal segments. That was in 1879, when Smith included them in his genus *Paracolletes*, and gave them the specific name of *marginatus*.

Previously, in 1862, Smith had published, in *Transactions of the Entomological Society*, London, the description of somewhat similar females, under the title of *Lamprocolletes venustus*. These, too, were black, banded with gold; but he did not mention a very unusual character of the eyes. The large compound structures have a number of long, sensory hairs projecting from between the convex facets, a feature which is found in only one other genus, *Apis mellifera*, the honey-bee of the hives. The elements of these hairs are, however, found in *Pachyprosopis haematostoma*, small, glossy, purple-black bees, whose large eyes, when viewed through the microscope, exhibit a number of short, stout, peg-like hairs among the cornules.

Smith's genus, *Lamprocolletes*, has now been merged in his more comprehensive one, *Paracolletes*, but I regret the supersedure, as the characters for this genus, and also those for his *Leioproctus*, are sufficient justification for the retention of his generic names. However, that is a matter to be referred to elsewhere. Professor Cockerell, my mentor in the mazes of taxonomy, in the *Annals and Magazine of Natural History*, 1913, reviewed these black and gold females, and, noting the hairy eyes, created the genus *Trichocolletes*. He had already written to Meade-Waldo, at the Museum in London, requesting him to study the compound orbits of Smith's *Lamprocolletes venustus*, and that entomologist had assured him that they, too, had the distinctive hairs, so the bees became *Trichocolletes venustus*. That was the last overseas record of these large and beautiful Australian natives.

Soon after the Great War had ended, I decided to pay some attention to these plumed honey-gatherers, which were collected at Brisbane and Birkdale, in Queensland, seven hundred or more miles from my home on Port Phillip. I have long refused to be daunted by distance, and the record from the far north did not deter me from endeavouring to find the bees close at hand. I waited until the spring month of October, and set out, for the hundredth time, to find some plumed bees. Fabre, you will remember, told naturalists to keep looking in the right place and

they would surely find, a dictum to which I whole-heartedly subscribe.

Where, one might ask, is the best locality? Well, I had searched, year after year, the blossoms of the Coast Tea-tree, the Beard-heath, the "Boobialla," the Coast-hop, the *Mesembryanthemum*, and dozens of other plants comprising the "Sandringham Flora," and there were no plumed bees on all that sea of bloom. Of course, I was not looking in the right place. In the dense growth I had passed over a few odd plants some three feet or more in height, and bearing numerous small, yellow-and-red pea-shaped flowers. The leaves are attenuated, sharp and hard, and these are responsible for the common name "Gorse-leaf Bitter-pea" *Daviesia ulicina* of the botanist.

Certainly I should not have neglected such richly nectariferous bloom, for had I not much experience with this genus, having harvested from it many tons of exquisite, pale, delicately-flavoured honey, perhaps the most attractive in the world. Never shall I forget the apiarist who had in his store-house 12 tons of honey, all sealed in thousands of snow-white combs, each holding one pound avoirdupois. The fragrance of that harvest permeated the atmosphere. I say I should not have passed over the *Daviesia*, though where that magnificent harvest was gathered there were "miles of bloom," whereas, on Port Phillip, I have to search many acres to find one plant.

Convinced that I was looking along the wrong avenue, I at last turned my attention to the rare Bitter-pea. After days of watching I observed a honey-gatherer hover for a minute or two over the blooms, and then disappear with remarkably rapid flight. It looked very like the familiar honey-bee, but its high treble note made me curious and eager to capture one. This I did with difficulty, after swooping through the air with my net many, many times in vain.

However, I have the bee in my bottle, and am able to study her with my lens. Even with that low power I am able to discern her hairy eyes, and the long, plumed pale hairs of her body. She conforms very nicely to Smith's description in everything except size; she is larger, measuring some 13 millimetres in length. She has bright red legs, the dense, yellow, hairy covering of the face, and the black abdomen with its golden bands. Smith's dried and contracted mummy could not be measured accurately, and his estimate of length might easily be astray. I am stressing her size because I have to use it as a specific distinction.

Of course, I was happy to add these fine bees to the fauna of Victoria, and, after all, such pleasures, small though they be, are very genuine, since they are based on a satisfactory reward

for one's labours. But human nature is a complex problem, for I no sooner establish one fact than I am again obsessed with a desire to uncover another. What of the males? Neither Smith nor Cockerell say anything about them.

Two years went by before I tasted again the sweets of accomplishment. It was October. I knew now that the right place was the blossoms of the Bitter-pea, so I sat down and waited. It was a glorious pastime, albeit a little trying on one's patience. However, at Black Rock, for that is where I found the bees, I inhaled the salt air of the sea and felt happy. Presently, when the air was quieter, I heard above my head a shrill note far too highly pitched for any honey-bee, and quite different in intensity from the treble note of the blue-banded bees of the Anthophoridae.

Peering into the atmosphere I observed darting specks of light and recalled the Belgian poet's words, "shoots like an arrow to the zenith of the blue." Just so, the males passed like arrows, and my net was almost of no avail. Of all bees, this species has the swiftest flight, and is most difficult to capture, even though one be experienced with the net of the collector. But I did catch a specimen, and since no one else has done so, I append to this essay a description of the allotype. For the moment I am satisfied to point out that the male of *T. venustus* is smaller than the female, for it measures only 11.5 mm. in length. The face, I say, is covered with dense yellow hair. The range of habitat is extended from Birkdale, in Queensland, to Black Rock, on Port Phillip. Permit me to leave it at that for the time being.

I prefer to go once or twice a year into the mountains, where the broken contours provide a relief from the long, level horizon of the sea. Moreover, the tall Eucalypts are in strong contrast to the low tea-tree of the coastline, and the lighter air is enjoyable for a change. I appreciate the mineral waters of the springs about Daylesford, and the flora of that high country affords me an opportunity for further work. On the stony northern slopes, where the native granite is broken into small particles by alternate frost and heat, there is a gritty soil that feeds a number of small shrubby plants and a forest of many-branched trees. Behold, among the former are the Bitter-peas, not the few, scattered gorse-leaf kind, but large areas of a narrow-leaf species, *Daviesia corymbosa*, which has flowers of similar size and colour.

I walked through acres and acres of *Daviesia*, listening for the shrill note of the yellow-banded bees. Well, I did hear it, but I could not get near enough to catch a bee. I secured from the blossoms three industrious females, which, intent on the harvesting of the delicate nectar and the rich orange-coloured pollen, did not escape me. I was spurred to greater effort, but the weather

turned cold, my patience ran out, the bees disappeared. I left the hills with regret, vowing that next October I would remain until I did secure the objects of my quest.

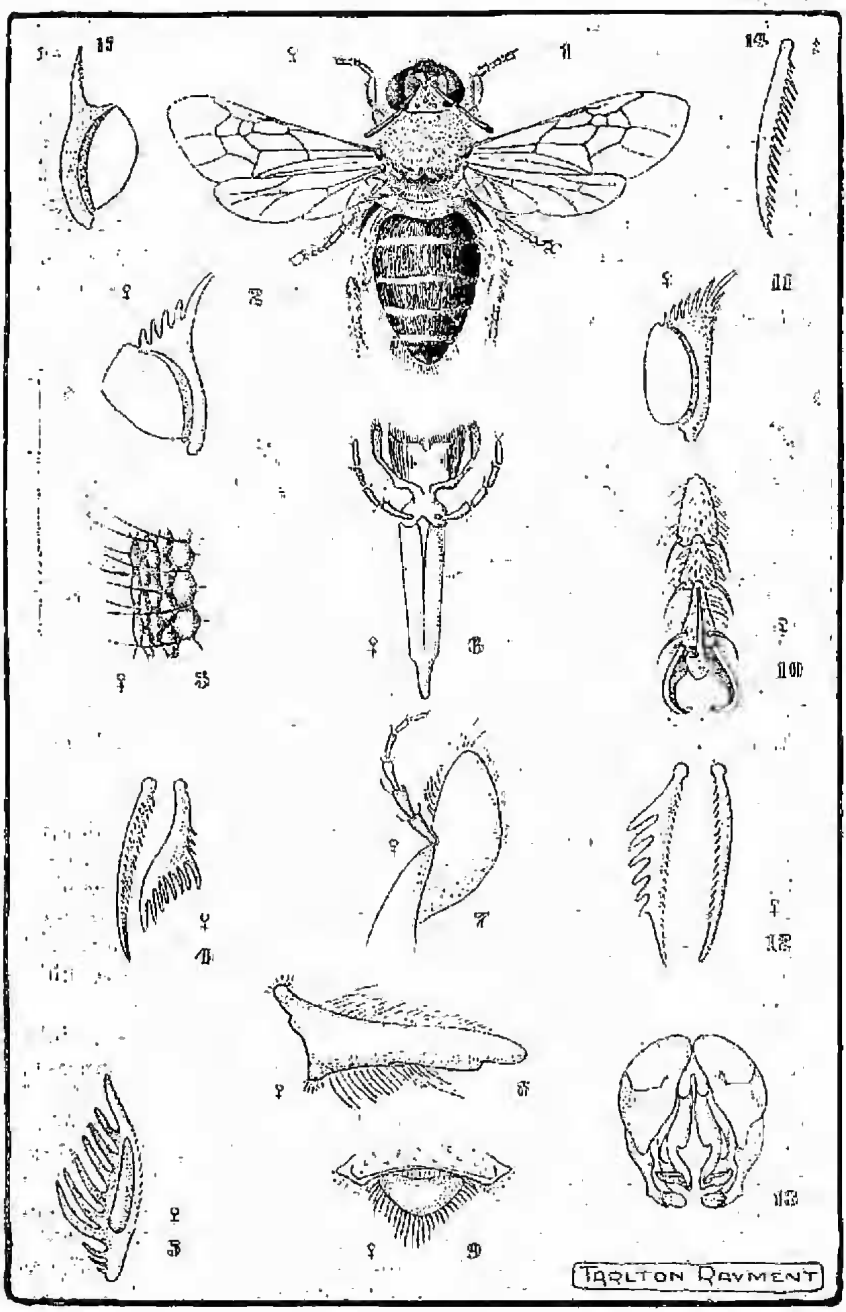
Alas! In the following year influenza robbed me of my strength, and pneumonia and toxaemia followed. When October opened I lay in the hospital with death lurking on the threshold. My doctor brought me back to the land of bees and sunlight, but a whole year went by before I was again strong enough to climb a mountain and drink the icy water of the springs.

In October, 1929, the entomologists of Melbourne planned an expedition to the hills of Macedon. I alone found three miserable bushes of *Daviesia* after some miles of walking. I had no net, so sure was I that the Bitter-pea was absent. Well, right under my nose I perceived a darting bee with a high-pitched note. I called imperativly for Clarence Borch, and he came running rapidly. "Strike!" And in his net there was the long-sought-for male. Not another was found. I had now both sexes to compare with my other specimens, and decided they were a new species, the chief distinction being the absence of golden hair from the faces, and the sexes being equal in stature, since both measure 12.3 millimetres in length.

The *Paracolletes marginatus*, which Smith described in his work, *New Species of Hymenoptera in the British Museum*, has no hair emanating from the eyes, and Dr. Cockerell thought these bees an example of mutation. According to the theory of De Vries, this phenomenon may arise suddenly: One of the daughters of a hairy-eyed *Trichocolletes* mother hatches out minus the adornments, and her inability to grow the eye-hairs is transmitted to some of her daughters. The structural change was not spread over aeons of time, but occurred suddenly, and the work of Mendel shows that the loss is a permanent one.

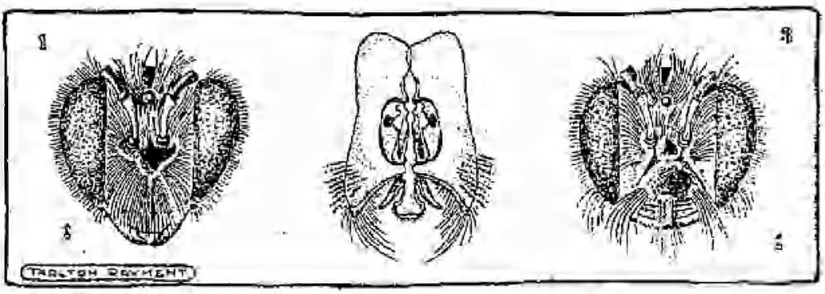
It may have been the other way about; the progeny of a naked-eyed *Paracolletes* may have contained an individual with hairs between the facets, and this accession has been transmitted to all its progeny. Could we have had the brood under critical observation, the number of naked-eyed and hairy-eyed specimens might have been in Mendelian proportions. It seems to me the short, peg-like hairs of *Pachyprosopis* may some day be absent from a specimen; or, on the contrary, I may yet find one of this genus exhibiting the long sensory type.

When Cockerell made his observation *P. marginatus* had been recorded only from the southern portion of Australia, namely, Cheltenham, Victoria, and Bridport, Tasmania, while his hairy-eyed specimens were described from Queensland. My records prove that both bees are to be found on the shores of Port Phillip; but,


TARLTON RAYMENT

whereas the *Trichocolletes* is a-wing only during the last of September and the whole of October, and is confined to visiting the Bitter-pea, the *Paracolletes* emerges later, during the heat of summer, and harvests from utterly different plants.

Both species are splendidly equipped for digging, and excavate shafts several feet in depth; both lay down from a broad tongue a liquid that hardens into a delicate silvery cell-lining of skin, and place in the cradle a sphere of pollen and honey just firm enough to maintain its shape. The sole brood contains males and females, and the larvae rest in the earth for ten months. A rapid development takes place during the last fortnight, and the males precede the females by two or three days.



1. Front of head-capsule of *Trichocolletes venustus* SMITH.
2. Genitalia of *T. venustus*; the plumosa hairs are a remarkable feature.
3. Front of head-capsule of *T. nigroclypeatus* RAYMENT. Note the hair in tufts on the clypeus.

The nests of *T. venustus* that I have observed continued down until a firm subsoil was reached, and the tumuli at the entrance were so solid that they maintained their volcano-like forms for the whole of the month. The *Paracolletes* mound is more friable, easily blown down, and is levelled within an hour or so. The males of some *Paracolletes* make a shrill, thin note when ranging over the flowers, but the note of *Trichocolletes* is much more intense.

Smith described another genus of golden-banded bees, the *Anthoglossa sericea*, and they, too, have a strong resemblance to the honey-gatherers I have already surveyed, but are closer in facial appearance to my *Trichocolletes nigroclypeatus*, for both have whitish hair at the margins of the face. The life-history of *Anthoglossae* is unknown to me, but the large strong comb of the tibial spurs is unsurpassed for digging, and the bees of both these genera must be the greatest of all insect tunnellers. I have followed the shafts of *T. venustus* down for over five feet, and can testify to the efficiency of the pick. The only *Anthoglossae* I have were

collected on the Grampian hills, and in the National Park, Queensland.

The homes of the banded-bees are never so close together as are the shafts of *Paracolletes*, which often have only six inches or so separating them, whereas those of *Trichocolletes* are many yards apart. An interesting feature is the changes in the colour of the hair of the various broods. In 1928 all the males from the only colony I know had deep, orange-coloured face-hair, but in 1929 all the males from the same colony had white hair at the orbital margins. I know that temperature has a great influence on the pigment of developing bees, and I have reared a brood of young queen bees, the progeny of a tan-coloured mother, *Apis ligustica*, that varied from golden-yellow to black; under normal circumstances and an equable temperature, the colour of her children was dark tan.

The spring of 1928 was abnormally dry and hot, August being noted for the prevalence of northerly winds; the vernal months of 1929 were decidedly cool, with frequent light showers. The colour of the honey-bee becomes darker with low registers, but the males of *T. venustus* were paler when the spring was a cold one. I would also remind you that the hills of Daylesford and Macedon enjoy a cool climate with much rain, and the *Trichocolletes* of the regions are distinctly paler in the face hairs.

KEY TO ILLUSTRATIONS (Page 159).

(1) Adult female *Trichocolletes nigoclypeatus* RAYMENT.
(2) Antenna-cleaner or strigil: Note the produced velum.
(3) Portion of compound eye showing sensory hairs.
(4) The remarkable tibial spurs.
(5) A view of inside the teeth of the spur.
(6) Glossa or tongue with long paraglossae and palpi.
(7) Maxillary palpus.
(8) Mandible or jaw.
(9) Labrum or lip.
(10) Tarsal joints and claws.
(11) Antenna-cleaner of *Paracolletes plumosus* SMITH.
(12) Tibial spurs of *P. tuberculatus* COCKERELL.
(13) Genitalia of *P. facialis*.
(14) Hind tibial spur of male *T. venustus* SMITH.
(15) Antenna-cleaner of male *T. venustus*.

In a letter to Mr. C. French, Jun., Mr. H. W. Ault, of Lakes Entrance, writes:—"On November 2 I discovered an Emperor Moth in my cage, which had emerged from a cocoon placed there at some time between April and July, 1924. The cocoons were pulled from a pepper-tree, and given to me by Mrs. Perkins."

TRICHOCOLLETES NIGROCLYPEATUS. *Sp. nov.*

Female.—Length 12.3 m.m., approx.

Head black, bright, wider than thorax; face marks nil, a tuft of whitish hair at each side; Frons with a minute shagreen, and with large evenly distributed punctures; Clypeus prominently convex, polished, with sparse coarse puncturing, the posterior edge with a few scattered long light hairs, the anterior with golden hair, shagreen well defined; Vertex developed to a sharp edge, with a fringe of long golden hair; compound eyes claret-brown, margins parallel, with long straw-coloured hairs between the facets; Genae with long white plumose hair; Labrum amber-red, subtriangular; Mandibulae dark red with black tips, with a strong inner tooth; Antennae black, apical ends of flagella obscurely fulvous.

Prothorax not visible from above, tubercules obscured by a tuft of golden hair. Mesothorax black, bright, with a minute shagreen and with even, but not dense puncturing, a few golden plumose hairs surroundings the disc. Scutellum slightly bigibbous, similar in colour, sculpture and hair. Postscutellum similar to scutellum. Metathorax very short, but similar to mesothorax in colour and sculpture.

Abdomen with dorsal segments black, dull, hind margin of first obscurely lighter, the others golden yellow fringed with pale hair, the segments having an excessively fine transverse striation; ventral surface similar to dorsal, but with numerous coarse punctures. Legs reddish-amber, coxae and a large patch on femora black, with long pale plumose hair; Tarsi redder, the hair reddish-golden; claws dark red; hind Calcariae red, exceedingly wide, with seven large, strong teeth and three small ones; the Strigil has five strong, long teeth, and the Velum is produced almost to a pyramid; Tegulae yellowish-amber, dark basally and anteriorly.

Wings sub-hyaline, iridescent, anterior 7.5 m.m.; Nervures sepia, first recurrent entering the second cubital cell at apical third of its length, the second recurrent entering the third cubital cell near apical end, basally slightly curved and falling short of Nervulus; cells radial, long and narrow, second and third cubital greatly contracted at top; Pterostigma inconspicuous, sepia colour; Hamuli thirteen in number, of moderate development.

Locality, Daylesford, Victoria, 12/10/27.

Allies: Close to *T. venustus*, Smith, which is larger, has brighter bands, and more hair of an ochreous tint; *Paracolletes marginatus*, Smith, which has no hair on the eyes; *Anthoglossa aureolincta*, Cockerell, which has black legs and which is larger.

Biological data: I find these females frequent only the plant *Davissia corymbosa* from which they harvest pollen of a dull orange colour, and nectar of a deliciously delicate flavour. No mating takes place in the flowers.